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AGS Studies Report

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Subject: AGS Shield Tests

Objective: To measure the beam induced radiation outside of the AGS: over the 10 foot sand shielding and at the Target Desk.

Method:
Dump the beam at J19 with a flip target and at D10 with a 1/2 lambda bump, then measure the radiation outside the shield with HP survey meters.

Dump the beam on the E20 catcher and measure the radiation at the Target Desk and its Quality Factor.

Also monitor the location of the losses in the AGS Ring using the RLRM loss monitor array.

Experiments:

Dumping beam at high energy on E20 has caused noticeable radiation readings on the Target Desk Chipmunk. The Chipmunk readings, here and in the East Building, were noted via the Datacon system for various AGS energies. About 1.4 TP per pulse, at a 2.8 sec Rep Rate, was dumped on E20. A Plot of Chipmunk radiation shows a strong energy dependence. (See Fig. 1.) A quick estimate of the Quality Factor was made at the Target Desk using a Neutron Ball and a GM counter; a very low QF (<1 with poor statistics) is indicated. The E20 beam catcher induced radiation at the Target Desk appears to be Muons from the catcher.

The leakage of the AGS Ring Shield was measured in the J super-period using the J19 flip target as a "point" source of radiation. About 15% of the internal beam was shaved by this target and the outside shield top radiation levels were measured by the HP group. The peak level seen was about 5 mRem/hr with about 2x10^11 shaved by J19. (The fraction of beam that actually interacted on J19 can only be guessed, the rest was caught by E20.) The "effective area" of the loss was estimated using plots of radiation vs position, both transversely (Fig 2) and longitudinally (Fig 3), giving about 2000 ft^2. The total fluence is estimated to be about 86 mRem-ft^2 per 10^12 protons lost at J19 (guessing 1/2 of the beam interacted here).

Beam was then dumped in the D superperiod by powering the E5AB bump (configured as a half lambda bump), turning off the RF, and allowing the beam to spiral in to hit here. Again HP took radiation readings over the loss area. The peak reading was 120 mRem/hr with all of the 1.4x10^12 lost in the area. The transverse extent of the losses were assumed to be the same as at J19 and the longitudinal extent is seen in Fig 4. The "effective area" here is about 1500 ft^2 and the total fluence 100 mRem-ft^2 per 10^12 lost in the area. Though the geometry of the losses are not as simple as the J19 case the loss pattern is more typical of accidental losses and the amount of beam lost is better understood.

Other observations:

In order to estimate the amount of beam interacting on J19, the beam radius was varied and the loss pattern was recorded. Though an estimate of the J19 fraction cannot be made, a plot(Fig 5) of the total loss at E20 and J19 areas as a fraction of total counts show that at inward radii, E20 does an excellent job of catching all the beam not interacting in J19.

Also the RLRM loss patterns were recorded when the beam was dumped on E20 at different energies while measuring the radiation at the Target Desk. Table 1 shows little energy dependence of E20 loss patterns, The fraction of RLRM counts at E20 and for the whole area do not change.

Conclusions:

The peak levels outside the AGS shield with 10 ft of sand cover is about 100 mRem/hr per 10^12 lost per pulse (2.8 sec Rep Rate).

The total fluence is about 100 mRem-ft^2 per 10^12 lost.

Fig 1

EAST BILDING RADIATION FROM E20 LOSSES

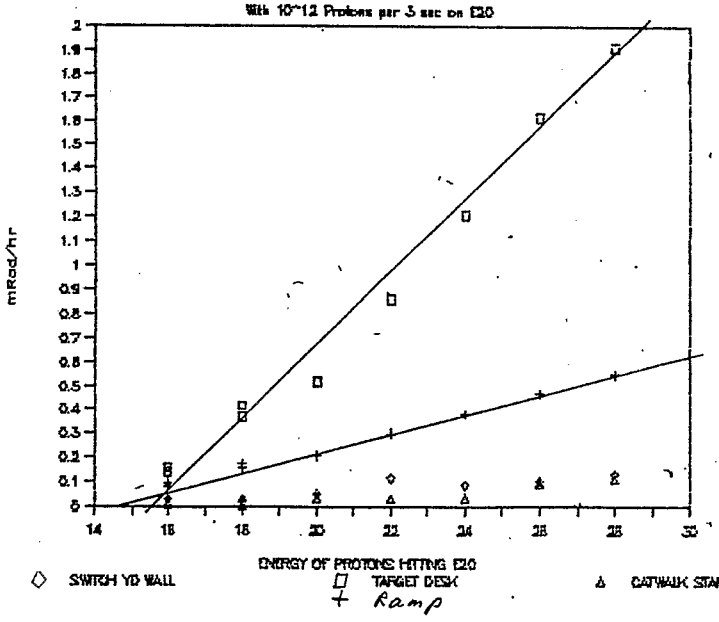
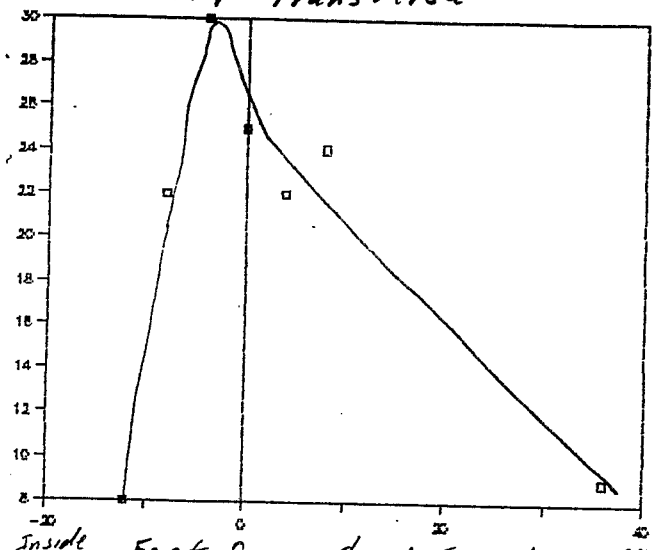


Table I

E20 AREA LOSS FRAC AS A FUNC OF ENERGY

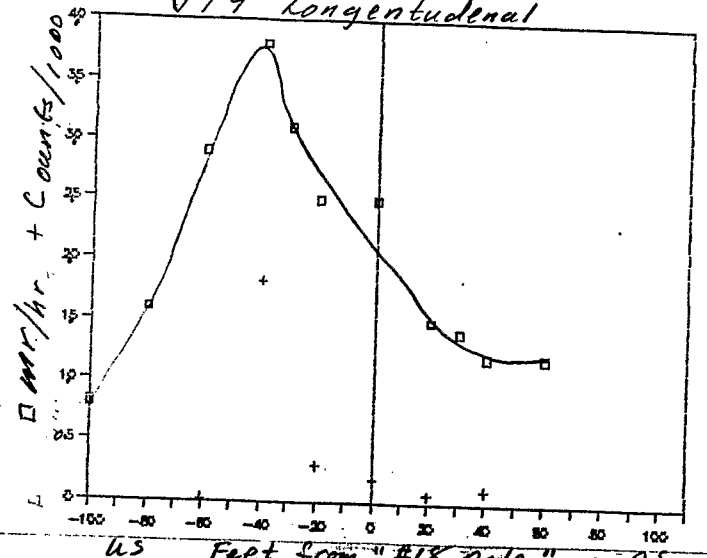
ENG	TOT/INT	LOC/TOT	E20/TOT
18	14	0.78	0.28
20	17	0.78	0.23
24	25	0.77	0.24
26	24	0.78	0.23
28	24	0.81	0.24

Fig 2 - Radiation Pattern
J19 - Transverse



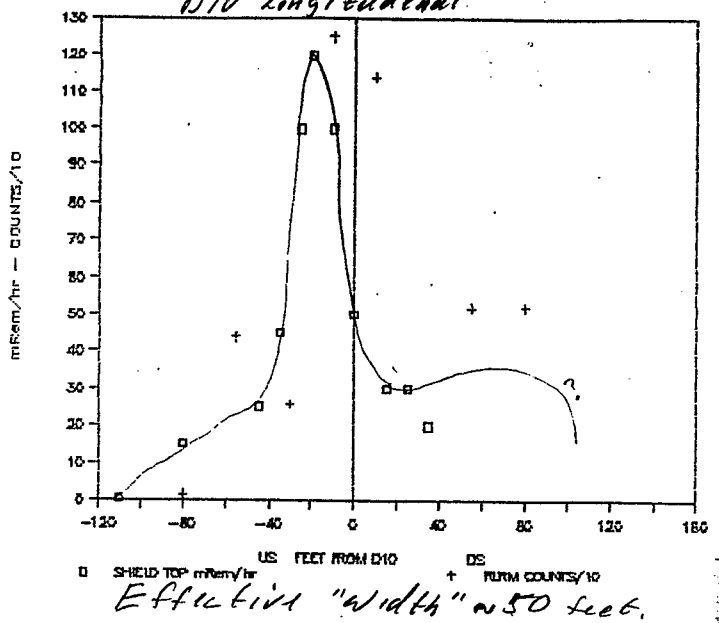
Effective Width ~30 feet

Fig 3 - Radiation Pattern
J19 Longentudenal



Effective "Width" ~70 feet

Fig 4 - Radiation Pattern
D10 Longitudenal



Effective "Width" ~50 feet.

Fig 5
E20 AS CLEAN UP FOR J19 TARGET